What is claimed is:

1. A magnetic recording medium comprising:

a recording layer which is formed of a ferromagnetic material;

a ferromagnetic atom-rich layer which is formed of a ferromagnetic material having a high ferromagnetic atom concentration as compared with the ferromagnetic material for forming the recording layer; and

a non-magnetic layer which exists between the recording layer and the ferromagnetic atom-rich layer.

2. The magnetic recording medium according to claim 1, wherein the ferromagnetic atom-rich layer is formed of one selected from the group consisting of Co, Ni, Fe, and CoNiFe alloy.

3. The magnetic recording medium according to claim 1, wherein the ferromagnetic atom-rich layer is formed of an alloy of a transition metal and one selected from the group consisting of Co, Ni, and Fe.

4. The magnetic recording medium according to claim 1, further comprising a magnetization-stabilizing layer which stabilizes magnetization of the recording layer, wherein the ferromagnetic atom-rich layer is positioned

between the magnetization-stabilizing layer and the recording layer, and the ferromagnetic atom-rich layer functions as a first enhancing layer which increases exchange coupling between the magnetization-stabilizing layer and the recording layer.

5. The magnetic recording medium according to claim 4, further comprising a second enhancing layer which increases exchange coupling between the recording layer and the ferromagnetic atom-rich layer, the second enhancing layer being disposed between the recording layer and the non-magnetic layer.

6. The magnetic recording medium according to claim 4, wherein the recording layer is formed of a material containing Co, Ni, or Fe, and the first enhancing layer is formed of a material containing Co, Ni, or Fe at a concentration higher than a concentration in the recording layer.

7. The magnetic recording medium according to claim 6, wherein the recording layer contains Boron.

8. The magnetic recording medium according to claim 4, wherein the enhancing layer has a film thickness of 0.2 to 2 nm.

9. The magnetic recording medium according to claim 1, wherein the non-magnetic layer is formed of Ru.

10. The magnetic recording medium according to claim 4, wherein the magnetization-stabilizing layer includes a first magnetization-stabilizing layer and a second magnetization-stabilizing layer, a second non-magnetic layer is provided between the first magnetization-stabilizing layer and the second magnetization-stabilizing layer, and an auxiliary enhancing layer, which increases exchange coupling between the first magnetization-stabilizing layer and the second magnetization-stabilizing layer, is provided at least at one of positions between the first magnetization-stabilizing layer and the second non-magnetic layer and between the second non-magnetic layer and the second magnetization-stabilizing layer.

11. The magnetic recording medium according to claim 10, wherein the auxiliary enhancing layer includes a first auxiliary enhancing layer which is formed between the first magnetization-stabilizing layer and the second non-magnetic layer, and a second ferromagnetic atom-rich layer which is formed between the second non-magnetic layer and the second magnetization-stabilizing layer.

12. The magnetic recording medium according to claim 1, further comprising a substrate, a second non-magnetic layer, and a magnetization-stabilizing layer which is positioned therebetween, which is formed of a ferromagnetic material, and which stabilizes magnetization of the recording layer, wherein the ferromagnetic atom-rich layer is positioned on a side opposite to the substrate with respect to the second non-magnetic layer.

13. The magnetic recording medium according to claim 1, further comprising a substrate, a second non-magnetic layer, and a second ferromagnetic atom-rich layer which is positioned therebetween, wherein the ferromagnetic atom-rich layer is positioned on a side opposite to the substrate with respect to the second non-magnetic layer.

14. A magnetic recording medium comprising:

an underlying base layer;

a recording layer which is formed of a ferromagnetic material;

a lattice spacing-adjusting layer which exists between the underlying base layer and the recording layer while making contact with the underlying base layer, which is formed of a ferromagnetic material, and which is provided to adjust lattice spacing for the underlying base layer and the recording layer; and

a non-magnetic layer which exists between the recording layer and the lattice spacing-adjusting layer, wherein:

a difference between lattice spacing on an orientation plane of the lattice spacing-adjusting layer and lattice spacing on an orientation plane of the underlying base layer is smaller than a difference between lattice spacing on an orientation plane of the recording layer and the lattice spacing on the orientation plane of the underlying base layer.

15. The magnetic recording medium according to claim 14, wherein the following relationship is satisfied:

$\Delta 1 > \Delta 2$

provided that the lattice spacing on the orientation plane of the recording layer is defined as a_1, the lattice spacing on the orientation plane of the lattice spacing-adjusting layer is defined as a_2, the lattice spacing on the orientation plane of the underlying base layer is defined as a_3, and mismatches $\Delta 1$, $\Delta 2$ are defined as follows respectively:

$$\Delta 1 = |(a_1-a_3)/a_3| \times 100$$

$$\Delta 2 = |(a_2-a_3)/a_3| \times 100.$$

16. The magnetic recording medium according to claim

15, wherein the mismatches $\Delta 1$, $\Delta 2$ further satisfy the following relationships:

$$\Delta 2 < \Delta 1 < 10.25; \text{ and}$$

$$(5/10.25) < (\Delta 1/\Delta 2) < 1.$$

17. The magnetic recording medium according to claim 14, wherein the lattice spacing-adjusting layer has the same crystal structure as that of the recording layer.

18. The magnetic recording medium according to claim 14, wherein a ratio of magnetic atom contained in the lattice spacing-adjusting layer is larger than a ratio of magnetic atom contained in the recording layer.

19. The magnetic recording medium according to claim 18, wherein a relationship of $Ms1 > Ms2$ is satisfied provided that saturation magnetization of the lattice spacing-adjusting layer is represented by Ms1, and saturation magnetization of the recording layer is represented by Ms2.

20. The magnetic recording medium according to claim 14, wherein the lattice spacing-adjusting layer is formed of one selected from the group consisting of Co, Ni, Fe, and CoNiFe alloy.

21. The magnetic recording medium according to claim 14, wherein the lattice spacing-adjusting layer is formed of an alloy containing a transition metal and one selected from the group consisting of Co, Ni, and Fe.

22. The magnetic recording medium according to claim 14, wherein the non-magnetic layer is formed of Ru.

23. The magnetic recording medium according to claim 14, wherein the lattice spacing-adjusting layer also functions as a layer which stabilizes magnetization of the recording layer and which increases coercive force of the recording layer.

24. The magnetic recording medium according to claim 1, wherein the recording layer has magnetization in an in-plane direction.

25. The magnetic recording medium according to claim 14, wherein the recording layer has magnetization in an in-plane direction.

26. The magnetic recording medium according to claim 1, wherein a magnetization curve of the magnetic recording medium with respect to an external magnetic field exhibits a hysteresis loop, a point, at which a rate of change of

magnetization with respect to the external magnetic field exhibits a local maximum when the external magnetic field is lowered after magnetization is saturated, exists in a positive area of the external magnetic field, and an exchange coupling magnetic field, which is determined from the magnetization curve, is not less than 1 kOe.

27. The magnetic recording medium according to claim 14, wherein a magnetization curve of the magnetic recording medium with respect to an external magnetic field exhibits a hysteresis loop, a point, at which a rate of change of magnetization with respect to the external magnetic field exhibits a local maximum when the external magnetic field is lowered after magnetization is saturated, exists in a positive area of the external magnetic field, and an exchange coupling magnetic field, which is determined from the magnetization curve, is not less than 1 kOe.

28. A magnetic recording medium comprising:

a recording layer which is formed of a ferromagnetic material;

a magnetization-stabilizing layer which is formed of a ferromagnetic material and which stabilizes magnetization of the recording layer;

a non-magnetic layer which exists between the recording layer and the magnetization-stabilizing layer;

and

a ferromagnetic atom-rich layer which exists at least at one of positions between the non-magnetic layer and the recording layer and between the non-magnetic layer and the magnetization-stabilizing layer and which is formed of a ferromagnetic material having a ferromagnetic atom concentration higher than that of the ferromagnetic material for forming the recording layer.

29. A magnetic recording apparatus comprising:

a magnetic recording medium;

a magnetic head which is used to record or reproduce information on the magnetic recording medium; and

a driving unit which drives the magnetic recording medium with respect to the magnetic head, wherein the magnetic recording medium comprises:

a recording layer which is formed of a ferromagnetic material;

a ferromagnetic atom-rich layer which is formed of a ferromagnetic material having a high ferromagnetic atom concentration as compared with the ferromagnetic material for forming the recording layer; and

a non-magnetic layer which exists between the recording layer and the ferromagnetic atom-rich layer.

30. A magnetic recording apparatus comprising:

a magnetic recording medium;

a magnetic head which is used to record or reproduce information on the magnetic recording medium; and

a driving unit which drives the magnetic recording medium with respect to the magnetic head, wherein the magnetic recording medium comprises:

an underlying base layer;

a recording layer which is formed of a ferromagnetic material;

a lattice spacing-adjusting layer which exists between the underlying base layer and the recording layer while making contact with the underlying base layer, which is formed of a ferromagnetic material, and which is provided to adjust lattice spacing for the underlying base layer and the recording layer; and

a non-magnetic layer which exists between the recording layer and the lattice spacing-adjusting layer, wherein:

a difference between lattice spacing on an orientation plane of the lattice spacing-adjusting layer and lattice spacing on an orientation plane of the underlying base layer is smaller than a difference between lattice spacing on an orientation plane of the recording layer and the lattice spacing on the orientation plane of the underlying base layer.

31. A magnetic recording apparatus comprising:

a magnetic recording medium;

a magnetic head which is used to record or reproduce information on the magnetic recording medium; and

a driving unit which drives the magnetic recording medium with respect to the magnetic head, wherein the magnetic recording medium comprises:

a recording layer which is formed of a ferromagnetic material;

a magnetization-stabilizing layer which is formed of a ferromagnetic material and which stabilizes magnetization of the recording layer;

a non-magnetic layer which exists between the recording layer and the magnetization-stabilizing layer; and

a ferromagnetic atom-rich layer which exists at least at one of positions between the non-magnetic layer and the recording layer and between the non-magnetic layer and the magnetization-stabilizing layer and which is formed of a ferromagnetic material having a ferromagnetic atom concentration higher than that of the ferromagnetic material for forming the recording layer.